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Kettner et al.

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(54) **MEDICAL TRACTION SYSTEM WITH LOW BACK-TRAVEL**

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(52) **U.S. Cl.**
CPC ... ***A61H 1/0222*** (2013.01); *A61H 2201/1418* (2013.01); *A61H 2201/164* (2013.01)

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See application file for complete search history.

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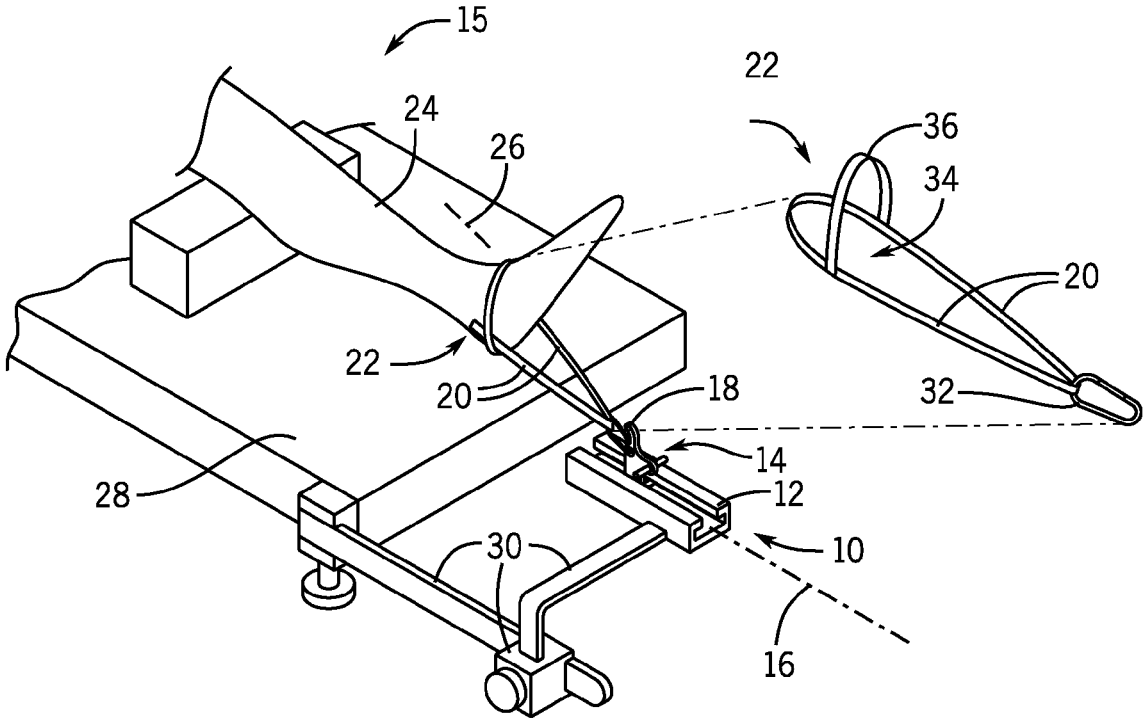
(57) **ABSTRACT**

A medical traction system provides an elongate track having a slide with a handle so that tensioning of the strap can be performed directly on the slide with improved tension sensitivity. The slide provides a cam mechanism with low back-travel automatically locking the slide when tension is released permitting one-handed operation.

15 Claims, 5 Drawing Sheets



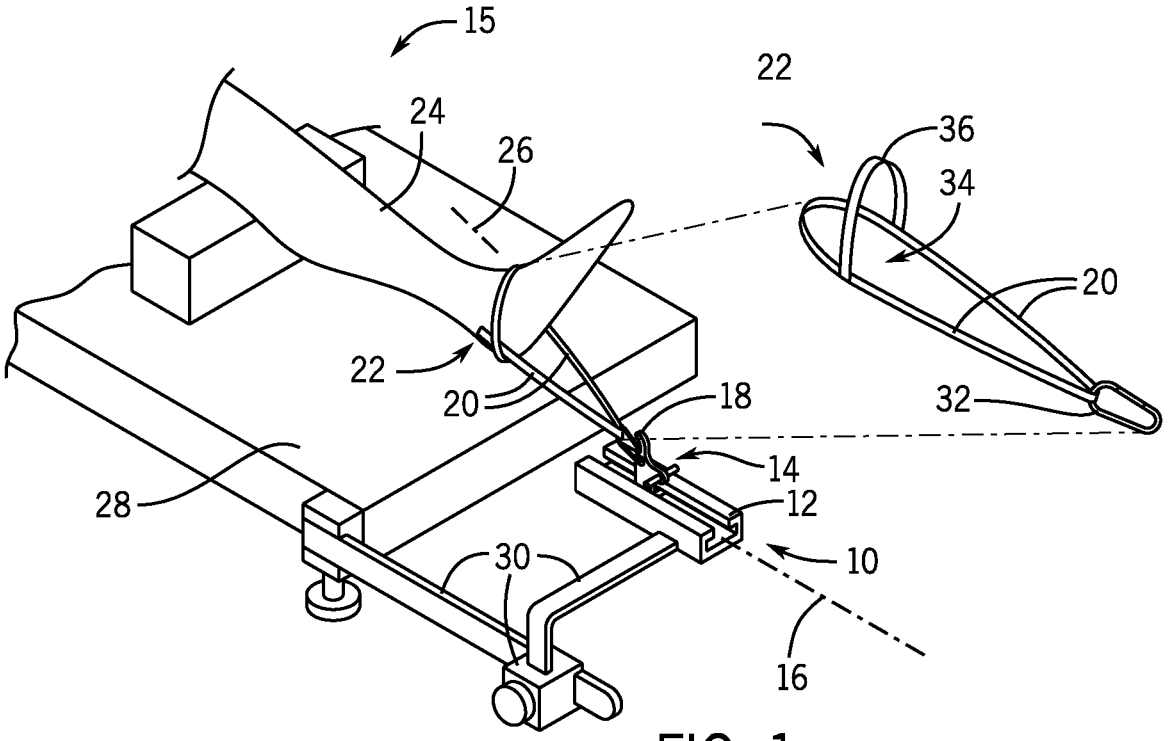

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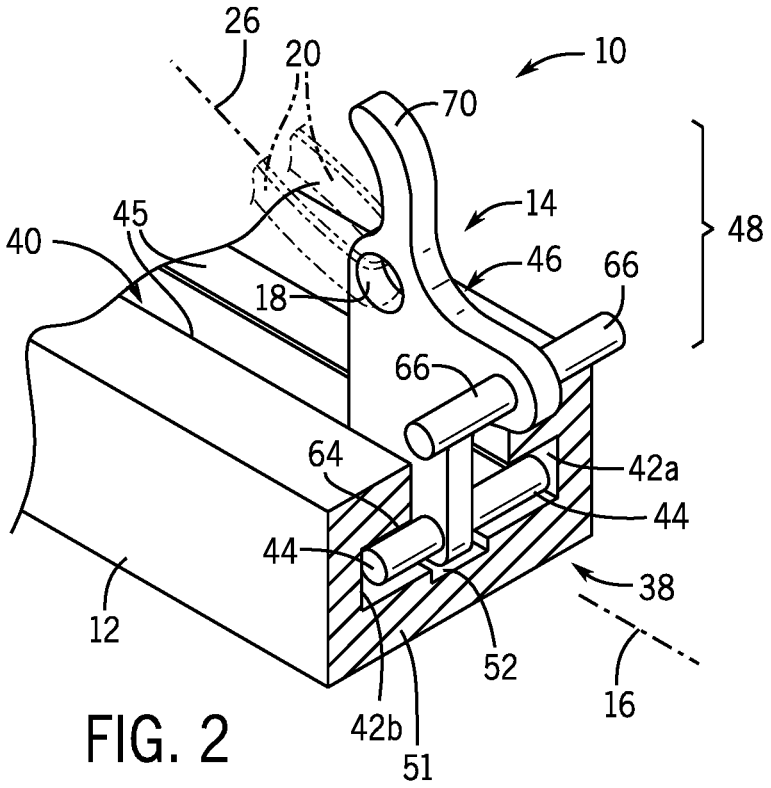
FIG. 1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20
10
70
14
48
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42a
44
44
38
12
52
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42b
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FIG. 2

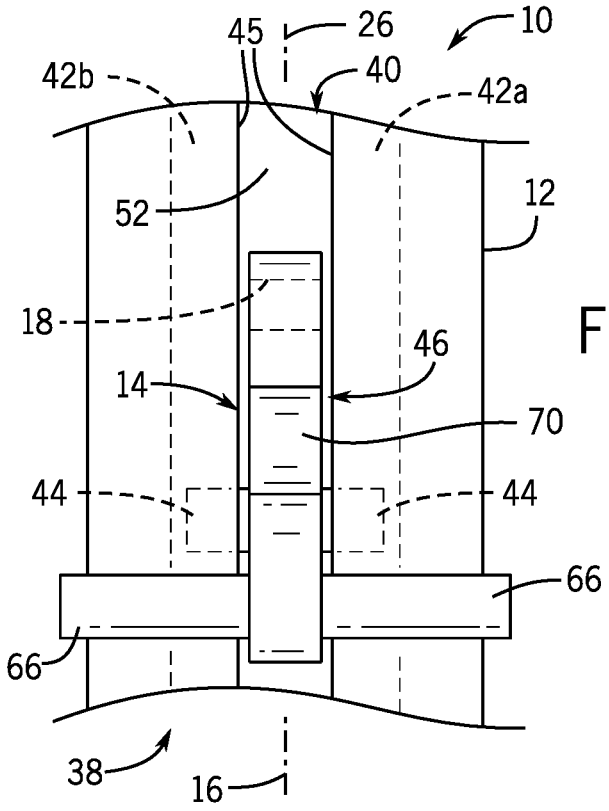
45
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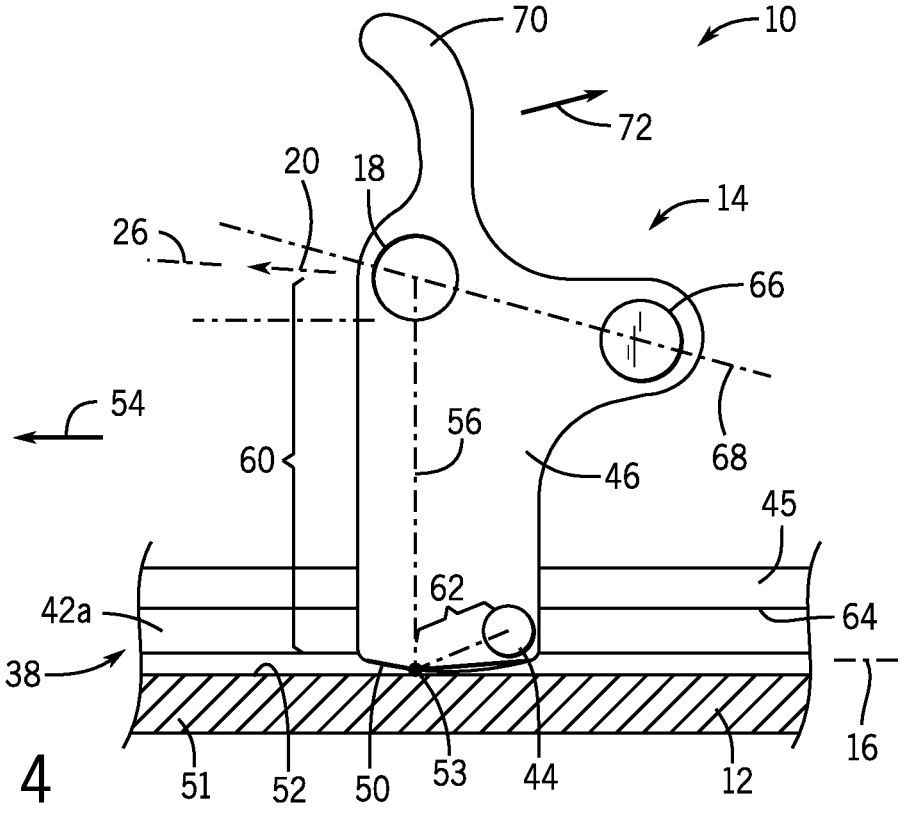
FIG. 3


70
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72
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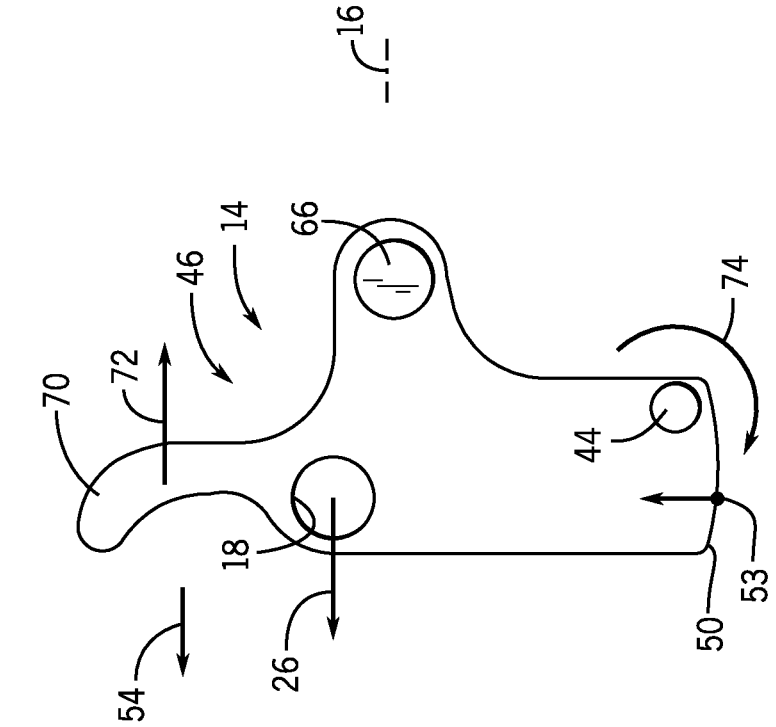
44
12

FIG. 4


16
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74
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FIG. 6

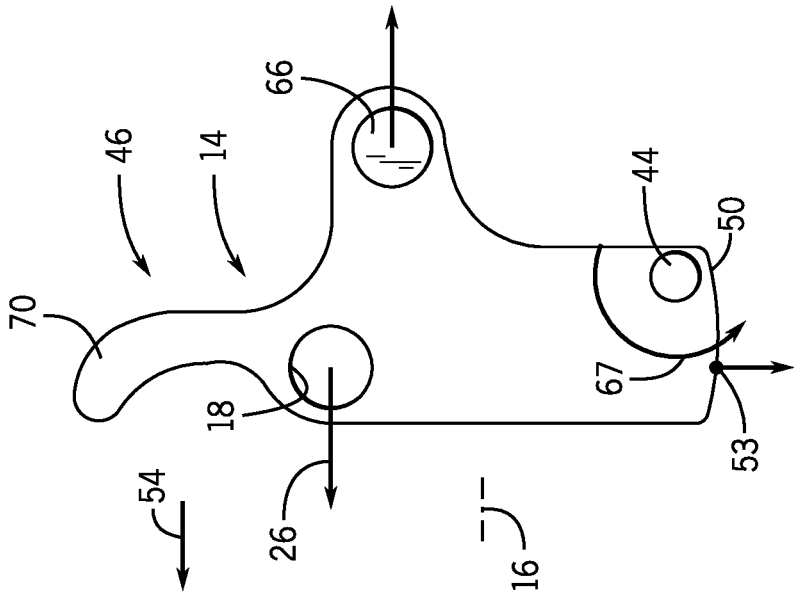
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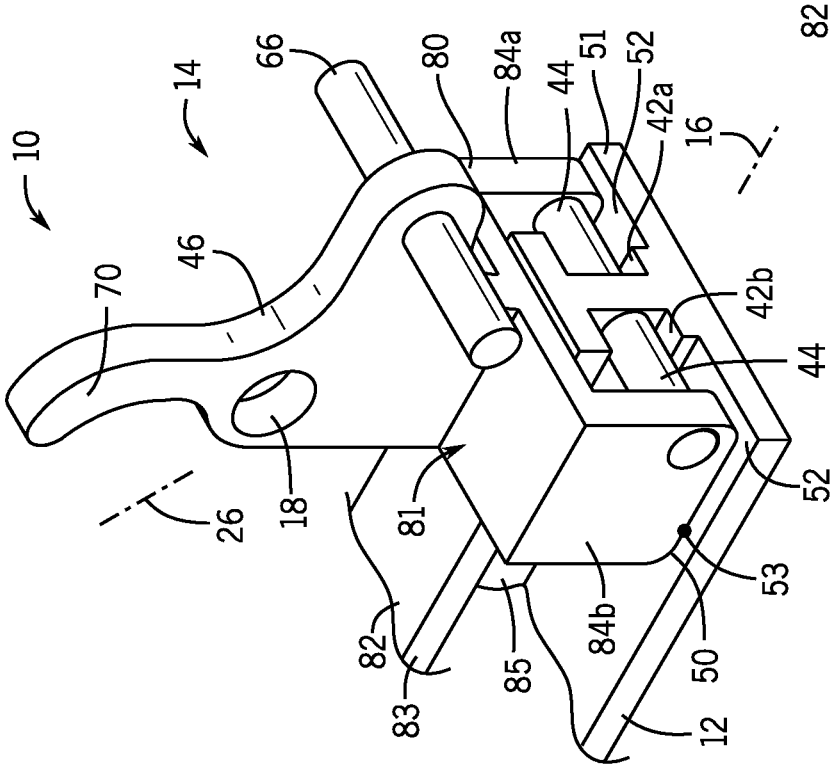
FIG. 5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14
66
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84a
44
51
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42a
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42b
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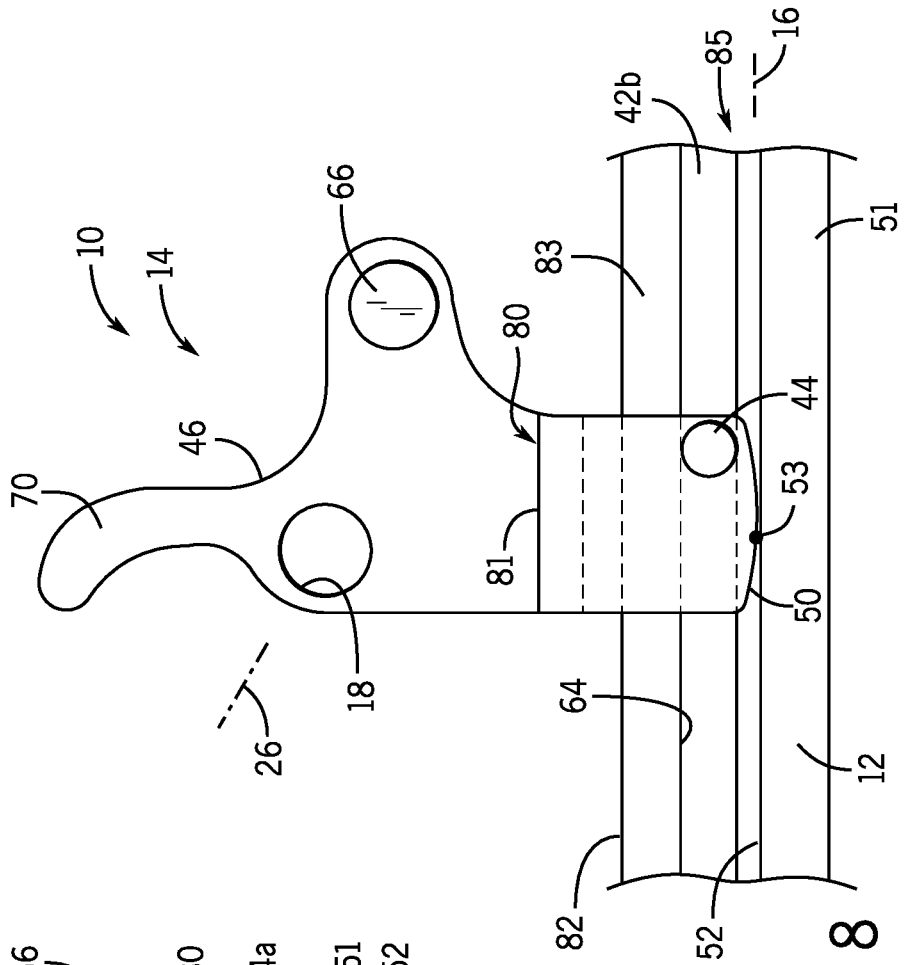
84b
82
85
50
83
12

FIG. 7


10
14
66
85
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42b
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FIG. 8

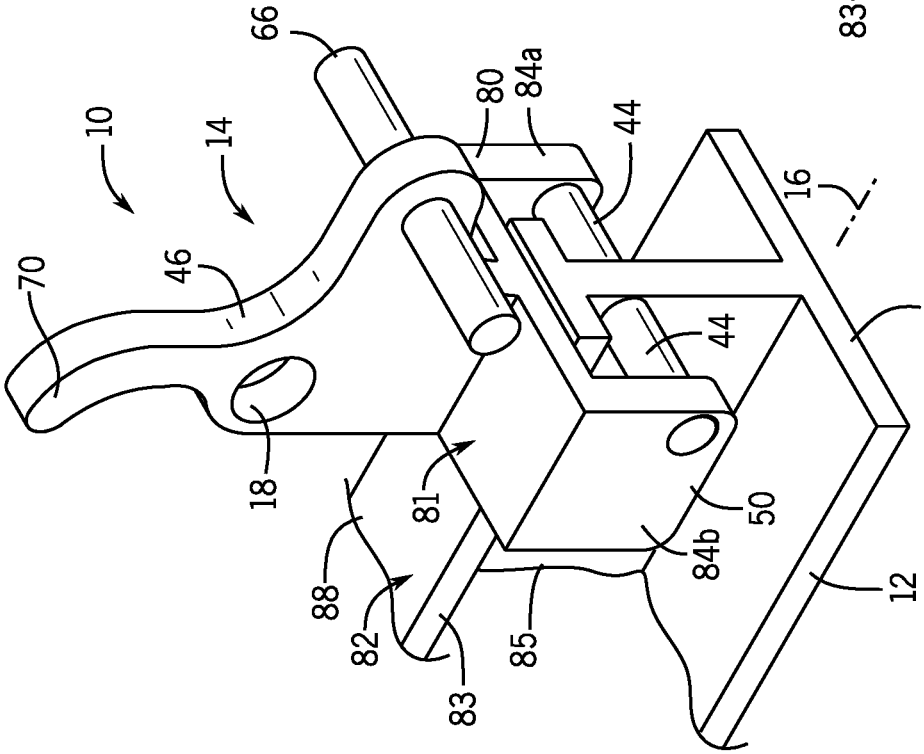
10
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FIG. 9

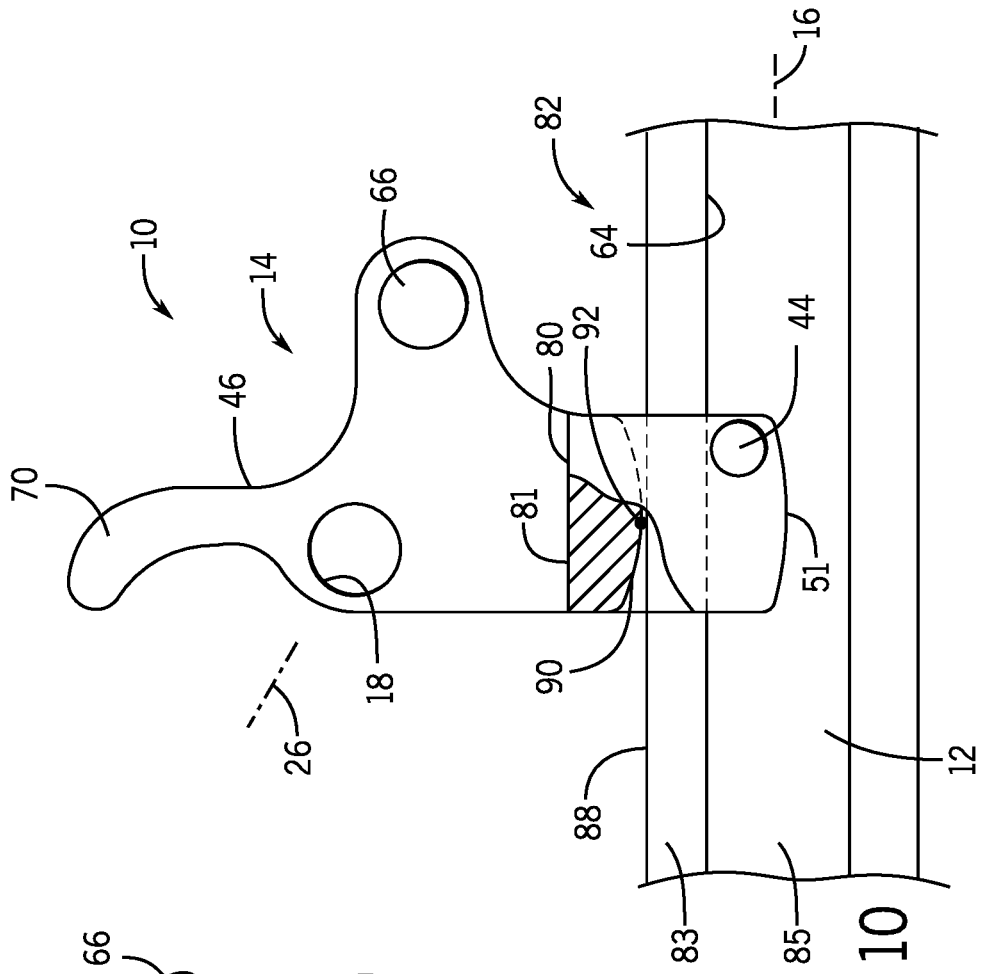
16
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FIG. 10

MEDICAL TRACTION SYSTEM WITH LOW BACK-TRAVEL

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

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CROSS REFERENCE TO RELATED APPLICATION

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BACKGROUND OF THE INVENTION

The present invention relates to medical distraction/traction devices for surgical procedures and in particular to a rapidly adjustable, intuitive traction device having low back-travel.

During surgery it may be necessary to apply a traction force to a limb such as the leg or arm. For this purpose, a flexible traction strap may be attached between the end of the limb, for example, the ankle or wrist, and a traction mechanism extending from a patient table or the like.

A commonly used traction mechanism uses cables and weights to apply a traction force that is well defined by the weights. All such traction mechanisms may be useful during rehabilitation but they can be inconvenient in the surgical suite, blocking access to the patient and being difficult to sterilize, set up, and adjust.

Simpler traction mechanisms have been developed, for example, using a simple turnbuckle inserted along the length of the traction strap to change the length of the strap. Such turnbuckle mechanisms, however, while simple, can impart undesired twisting to the traction strap, are slow to adjust, and have a limited adjustment range. They also can make it difficult to assess the amount of traction force being applied because of the high mechanical advantage between the turnbuckle screw action and the force applied to the turnbuckle.

A simple slide and locking knob can be used, where the strap is grasped to directly tension the strap while the slide is adjusted to remove any slack and the knob tightened, often by a second individual. By grasping the strap directly, a good intuitive sense of tension can be quickly obtained but there can be an undesirable relaxation in the traction force caused by slight elasticity in the strap between the point of tensioning and the slide when the strap is released.

SUMMARY OF THE INVENTION

The present invention provides a compact surgical traction device allowing a single individual to accurately and intuitively tension a patient's limb. The invention provides a track with a traveler having a handle so that tensioning of the strap can be performed directly on the traveler tensioning the limb for intuitive control. The traveler provides a cam mechanism automatically locking the slide when tension is released with low back-travel.

Specifically, in one embodiment, the invention provides a medical traction system having an elongate track adapted to attach to a patient support to extend along an adjustment axis positionable fixed with respect to a patient on a patient support. A traveler provides a traction strap attachment point and a first handle for tensioning a traction strap by pulling the traveler along the elongate track, the traveler further providing an upwardly extending lever and first and second

cam surfaces engaging with the elongate track to: (a) allow free sliding of the traveler along the track in an adjustment state with the upwardly extending lever within the first angular range about a horizontal axis perpendicular to an extent of the track; and (b) lock the traveler on the track in a fixation state with the upwardly extending lever at a locking angle about the horizontal axis tipped relative to the first angular range toward the patient support.

It is thus a feature of at least one embodiment of the invention to provide rapid and intuitive tension control by allowing the operator to pull directly on the traveler attached to the traction strap thereby sensing the tension during this adjustment.

The traction strap attachment point may be on the upwardly extending lever whereby tension on the tensioning strap urges the first and second cam surfaces into the fixation state.

It is thus a feature of at least one embodiment of the invention to allow the force of tension to automatically increase the restraining force on the cams, eliminating the need for difficult to overcome biasing of the springs or the like.

The traction strap attachment point may be a hole.

It is thus a feature of at least one embodiment of the invention to provide a simple but positive attachment of the traction strap to the traveler that can resist dislodgment at a variety of angles.

The first handle may be attached to the upwardly extending lever at a first handle attachment point no higher than the traction strap attachment point.

It is thus a feature of at least one embodiment of the invention to provide a handle that relieves the force of engagement on the cam surfaces while providing a slight torque on the handle that keeps the surfaces engaged for low back-travel when the handle is released.

A line between the first handle attachment point and the strap attachment point maybe angled with respect to the adjustment axis by at least 100 and less than 30° upwardly toward the patient to approximate an angle of the traction strap during use.

It is thus a feature of at least one embodiment of the invention to align the handle with the axis of force on the traction strap for improved intuitive tensioning control by the user.

The first handle may be a bar extending from the handle on both sides of the handle in the direction perpendicular to the adjustment axis.

It is thus a feature of at least one embodiment of the invention to provide a T-handle type design that can be simply integrated with the lever while spreading the force of traction evenly over a user's fingers.

The traction system may further include a second handle positioned on the upwardly extending lever at a point no lower than the traction strap attachment point.

It is thus a feature of at least one embodiment of the invention to displace a release handle from the tensioning handle to enlist the force on the traction strap to provide a torque releasing the first and second cam surfaces for rapid release of tension.

The second handle maybe an arcuate extension of the upwardly extending lever concave toward the patient.

It is thus a feature of at least one embodiment of the invention to provide a trigger shape indicating the operation direction of the second lever and a second lever design providing reduced finger purchase that intuitively steers the individual to the first handle for tensioning.

A force on the traction strap attachment point may produce a torque on the upwardly extending lever pressing the first and second cam surfaces against the elongate track with a normal force at least two times the force on the traction strap attachment point.

It is thus a feature of at least one embodiment of the invention to provide appropriate mechanical advantage to convert normal patient traction forces into a fixation force between the track and traveler.

The traveler may provide guide surfaces engaging with the elongate track in the adjustment state to align the traveler with the adjustment axis.

It is thus a feature of at least one embodiment of the invention to prevent binding between the track and traveler with slight off axis forces that may be expected in a surgical traction.

A line between the traction strap attachment point and a pivot point defining rotation of the upwardly extending lever within a vertical plane of the adjustment axis may be within 10° of vertical when the elongate track is horizontal and the upwardly extending lever is in the fixation state.

It is thus a feature of at least one embodiment of the invention to provide the fixation state with the lever in a position of maximum torque from the expected traction force to minimize inadvertent release of the traction device from off axis forces.

The elongate track may provide a tubular channel open at a slot along the extent of the elongate track with the first and second cam surfaces fitting within the channel and the upwardly extending lever passing through the slot, wherein the first and second cam surfaces engage interior surfaces of the elongate track so that the fingers of an average adult operator are blocked from contact with the first and second cam surfaces in the elongate track.

It is thus a feature of at least one embodiment of the invention to provide a design that removes potential pinch points from contact with the user.

The first cam surface may be a shaft extending perpendicularly from the adjustment axis and fitting within opposed corresponding interior grooves of the elongate track to be guided by the interior grooves along an extent of the track independent of contact between the traveler and other portions of the elongate track and wherein the second cam surface is a portion of a second lever extending from the shaft and angled with respect to the first lever.

It is thus a feature of at least one embodiment of the invention to provide a well-defined pivot point that may move along the adjustment axis smoothly without looseness or binding.

These particular objects and advantages may apply to only some embodiments falling within the claims and thus do not define the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective, fragmentary view of a patient table and a traction mechanism fixed with respect to the patient table per the present invention positioned to apply traction on a patient's leg and showing, as an inset, a representative traction strap;

FIG. **2** is a perspective cross-sectional view of the traction mechanism of FIG. **1** showing a traveler that may be slidably positioned along an elongate track, the traveler providing an upwardly extending lever, a tensioning and release handle, and cam surfaces engaging the elongate track in an enclosed channel of the elongate track;

FIG. **3** is a fragmentary top plan view of the channel **38** of FIG. **2** showing the protection of the cam surfaces within the channel of the elongate track and the alignment provided by a channel **38** slot and left and right walls of the upwardly extending lever;

FIG. **4** is an elevational cross section taken along a midline of the track of FIGS. **1** and **2** showing the internal cam surfaces within the elongate track and the relationship to the traction strap attachment point and the first and second handles for tensioning and releasing tension on the traction strap;

FIG. **5** is a simplified representation of the lever of FIG. **4** during a tensioning process showing forces that tend to provide close abutment of the cam surfaces for rapid engagement when the tensioning handle is released;

FIG. **6** is a figure similar to that of FIG. **5** during the release process showing reverse torsion provided by force on the release handle causing the tension strap to promote rapid release of the traveler;

FIG. **7** is a figure similar to that of FIG. **2** showing an alternative embodiment to the traction mechanism of FIG. **2** in which the cam surfaces are within an enclosure provided by the traveler rather than the track;

FIG. **8** is a figure similar to that of FIG. **4** for the embodiment of FIG. **7**;

FIG. **9** is a figure similar to FIG. **7** showing a displacement of one of the cam surfaces to an upper portion of the track; and

FIG. **10** is a figure similar to that of FIG. **8** for the embodiment of FIG. **9**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1**, a medical traction system **10** may provide for an elongate track **12** having a traveler **14** movable along the track **12** to follow an adjustment axis **16**. The traveler **14** may include a strap attachment point **18** communicating by means of straps **20** with a harness **22** that may attach to an end of a limb **24** of a patient **15**.

The elongate track **12** may be fixed with respect to a patient support **28** holding the patient **15**, for example, a patient table, by means of an adjustable arm assembly **30** or other similar mechanism so that motion of the traveler **14** can be used to apply a traction force through the straps **20** and harness **22** to the limb **24** along traction axis **26** generally aligned with the straps **20**.

Generally the elongate track **12** will be positioned using the adjustable arm assembly **30** or other mounting system, preferably so that the traction axis **26** and adjustment axis **16** lie in the same vertical plane, although generally the traction axis **26** will be angled with respect to the adjustment axis **16** upward toward the patient by an angle from 10° to 30° and some vertical misalignment is expected.

In one embodiment, the straps **20** and harness **22** may be constructed of a polymer webbing such as nylon or the like. The straps **20** may be formed into a loop **34** having a first end toward the traveler **14** connected to the traveler **14** either directly or through a releasable connector **32** such as a spring clip that may be attach releasably to a hole or other feature of the traveler **14**. Near the patient **15**, the loop **34** may fit around the heel of the patient **15** (in one embodiment) and be retained by an upwardly arching stabilizer strap **36** attached to and passing from one side of the loop **34** on one side of the heel up over the front of the foot and back down to attach to the loop **34** on the other side of the heel. The heel portion of the loop **34** and the strap **36** form the harness **22**.

Referring now to FIG. **2**, in one embodiment the track **12** may provide a generally C-shaped channel **38** having a generally rectangular cross-section and oriented to present an upwardly open slot **40** extending along the adjustment axis **16**. The slot **40** communicates with a central cavity of the channel **38** providing left and right grooves **42***a* and **42***b* opening in opposition toward each other and extending along the length of the track **12** as aligned with the adjustment axis **16**. These grooves **42** may receive a transverse cylindrical shaft **44** of the traveler **14** extending perpendicularly to the adjustment axis **16** to slidably move along the adjustment axis **16**. The grooves **42** and shaft **44** are sized so that the transverse cylindrical shaft **44** is generally resistant to substantial vertical motion perpendicular to the adjustment axis **16**.

The shaft **44** may provide a pivot for an upwardly extending lever **46** of the traveler **14** receiving the shaft **44** transversely therethrough at a lower end within the channel **38** and extending upwardly through the slot **40** to present an exposed portion **48** that may be grasped by a user. The lever **46** may be constructed of a plate having a width substantially equal to a width of the slot **40**, a length along the adjustment axis **16**, and a height of 2 to 5 inches in one embodiment. A front edge the lever **46** provides the strap attachment point **18**, for example, in the form of a transverse hole through a plate forming the lever **46**.

Referring also to FIG. **3**, as noted, the width of the slot **40** is such as to present opposed slot walls **45** which slidingly abut left and right surfaces of the lever **46** to guide the lever **46** along the adjustment axis **16** without substantial twisting about its vertical axis as shown. This rotational constraint also preserves transverse orientation of the shaft **44** preventing a binding or jamming of the shaft **44** within the grooves **42**. It will be appreciated that the lever **46** as attached to the shaft **44** is also prevented from vertical lifting out of the slot **40** or downward vertical motion by the upper surfaces and lower surfaces of the grooves **42** which closely slidingly abut corresponding surfaces of the shaft **44**. As supported by the shaft **44**, the lever **46** rotates about a horizontal axis of the shaft **44** within a vertical plane aligned with the alignment axis.

Referring also to FIG. **4**, a lower edge **50** of the plate forming the lever **46** within the channel **38** of the track **12** may contact an upper surface **52** of a bottom wall **51** of the channel **38** at a contact point **53** when the lever **46** rotates in a forward direction **54** toward the patient **15**. This position of contact will define a fixation state of the lever **46** defined by its angle. When the lever **46** is in the fixation state, a lever axis **56** of the lever **46** (extending from the strap attachment point **18** to the contact point **53**) will approach vertical and ideally within 30° of vertical with respect to a horizontal plane aligned with the adjustment axis **16**. This orientation roughly perpendicular to the traction axis **26** increases the torque on the lever **46** about the shaft **44** caused by force on the traction axis **26** and maximizes a range of angles of the traction axis **26** providing such high torque.

More specifically, force applied along the traction axis **26** will operate on a first lever length **60** between the strap attachment point **18** and the shaft **44** to rotate the lever **46** in a counterclockwise direction as depicted in FIG. **4** increasing the contact force between the lever **46** and the track **12** at contact point **53** to prevent sliding motion of the traveler **14** toward the patient **15**. Generally, the force of such contact and hence the ability of the traveler **14** to resist movement will be a function of the force on the traction axis thus preventing slippage at a range of forces of traction. More specifically, the force of contact at contact point **53** will be greater than the force of traction by a ratio of the lever length **60** and a lever length **62** defined between the shaft **44** and the contact point **53**, thus providing a mechanical advantage of two or preferably at least three times ensuring that the force between the lever **46** and track **12** and contact point **53** is sufficient to prevent sliding of the traveler **14** with respect to the track **12**.

Referring still to FIG. **4**, it will be appreciated that this locking of the traveler **14** on the track **12** is caused in this embodiment by two opposed cam surfaces, the first cam surface formed by contact between an upper portion of the shafts **44** and downwardly facing surface of upper walls **64** of the groove **42** and the second cam surface being between the lower edge **50** of the lever **46** and the upper surface **52** of the bottom wall **51** of the channel **38** of the track **12** at contact point **53**. Referring to FIG. **3**, these cam surfaces of the contact points shaft **44** and lower edge **50** will be safely protected within the channel **38** to shield healthcare professionals from potential pinch points and to shield the surfaces from contamination, for example, from liquids which might reduce the desired camming friction.

Referring now to FIGS. **2** and **4**, in one embodiment, a T-bar handle **66** may be attached at a rear edge of the lever **46**. The T-bar handle **66** may provide a shaft extending transversely through the lever **46** to extend on either side of the lever **46** by an amount allowing a gripping of the T-bar handle **66** by the fingers of a healthcare professional. The T-bar handle is sized to allow the healthcare professional to provide substantial force to the T handle **66** commensurate with the desired amount of traction while rotating the lever **46** away from the fixation state to a release state allowing the traveler **14** to be drawn backward along the track **12** to increase the tension on the straps **20** along the traction axis **26**. In one embodiment, as depicted in FIG. **4**, the handle **66** may be along a line of action **68** extending between the handle **66** and the strap attachment point **18** within a vertical plane of the adjustment axis, this line of action **68** desirably aligned with the traction axis **26** in anticipated use situations. In this way, the handle **66** is located so that a pulling on the handle **66** causes the user to experience fully the tension along the traction axis **26** for a quick intuitive traction adjustment.

Referring now also to FIG. **5**, the position of the handle **66** on the lever **46** may be desirably at or below the height of the strap attachment point **18** measured with respect to the contact point **53** and desirably below so that pulling on the handle **66** together with the tension of the straps **20** on the lever **46** provide a very slight counterclockwise rotational torque **67** to the lever **46** about the shaft **44** keeping the lower edge **50** of the lever **46** in close contact with the upper surface **52** of the channel **38** while reducing contact pressure at contact point **53** enough to allow sliding of the lever **46** within the channel **38** rearward to increase traction force. This close contact during adjustment, and in particular when increasing the traction force, ensures that when the handle **66** is released there is little counterclockwise rotation of the lever **46** that might decrease the traction force by loosening the straps **20** with rotation of the lever **46** forward toward the patient **15**.

Referring now to FIGS. **4** and **6**, during use, the traveler **14** is pulled away from the patient to tension the straps **20** by a healthcare professional pulling the handle **66** away from the patient **15**. When the handle **66** is released, tension on the straps **20** pulls the lever **46** so that the cam surfaces of the shaft **44** and the lower edge **50** engage the track **12** to prevent forward motion. There is very little back travel

because of the torsion described above which keeps the cam surfaces close together during the adjustment process.

When it is time to release the tension on the straps **20**, the lever **46** may be pulled backwards away from the patient **15** using a second handle **70**. The second handle **70**, in one example, may be an upward extension of the lever **46** above the strap attachment point **18**. In one embodiment, the handle **70** is given a forwardly concave surface suggesting a trigger and thus the proper direction of activation for release of the traveler **14**. Pulling backward on the handle **66** along release axis **72** disengages the cam surfaces allowing the traveler **14** to move forward toward the patient under the force of the tension on the straps **20**.

As best seen in FIG. **6**, by placing the handle **70** above the strap attachment point **18**, force on the second handle **70** along the release axis **72** together with the force along the traction axis **26** from the straps **20** creates a slight clockwise torsion **74** around the shaft **44** that lifts the lower edge **50** from the contact point **53**. The force along traction axis **26** then quickly pulls the traveler **14** toward the patient **15** quickly releasing tension in a set of cascading motions.

As discussed above, it will be appreciated that the locking of the lever **46** in the track is caused by two camming surfaces of the upper surface of the shaft **44** pressing against the upper walls **64** of the groove **42** and the lower edge **50** pressing downward at point of **53** on the upper surface **52** of a bottom wall of the channel **38**. Generally, the frictional forces imposed by these two camming surfaces need not be equal (in fact one could be a bearing) provided one such frictional force of contact is sufficient to restrain the lever **46** against longitudinal motion. In this regard the cams of the invention should be regarded as points of pressure that operate together to create frictional forces even though the frictional forces may be dominant on one of the surfaces.

Referring now to FIGS. **7** and **8**, the principles of the present invention can be implemented with changes in the relationship between the track **12** and the traveler **14**, and in particular by changing the enclosing track **12** surrounding the camming surfaces described above into an enclosing traveler **14** surrounding the track. In one such embodiment, the elongate track **12** may be in the form of a T-bar **82** having a horizontal bar portion **83** spaced by a central vertically downwardly extending stem portion **85** above the horizontal bottom wall **51**. In this embodiment, the lever **46** may extend downward in a saddle block **80** having a horizontal portion **81** extending left and right from the connection to the upper portion of the lever **46**. This horizontal portion **81** at its left and right edges connects with the upper edges of vertical walls **84***a* and **84***b* which extend downward to flank the T-bar **82**. The T-bar **82**, in the space between the bar **83** and the bottom wall **51**, provides grooves **42***a* and **42***b* which now open in opposite directions from the stem portion **85** and are formed between a lower surface of the bar of the T-bar **82** and the bottom wall **51**. Again, these grooves **42** receive corresponding shafts **44** passing inwardly, respectively, from outer vertical walls **84***a* and **84***b* of the saddle block **80**.

In this embodiment, each of the outer vertical walls **84** provides a lower edge **50** as described above providing a contact point **53** between the lower edge **50** and the upper surface **52** of the bottom wall **51**. These contact points provide a first of two opposed cam surfaces that work with a second cam surface at the contacts between the shafts **44** and the lower surfaces of the bar of the T-bar **82**.

Referring now to FIG. **9**, this design may be modified slightly, for example, using a T-bar **82** whose stem portion **85** is sufficiently tall as to prevent contact between the lower edge **50** of the vertical walls **84** and the upper surface **52** of the bottom wall **51**. In this case, the second camming surface is provided between the upper surface **88** of the horizontal bar portion **83** of the T-bar **82** and a bottom surface **90** of the horizontal portion **81** of the saddle block **80**. Contact between these services provides in the fixation state a contact point **92** analogous to contact point **53**. The operating principles of these devices of FIGS. **7**, **8**, **9**, and **10** may otherwise follow those described in the embodiments related to FIG. **2**.

Generally, the structures of the track **12** and the traveler **14** may be constructed of a sturdy metallic material such as aircraft aluminum or stainless steel to be easily sterilized and cleaned. It will be appreciated in this regard that the track **12** may be open at one or both ends to allow easy disassembly of the track **12** and traveler **14** also for cleaning.

Certain terminology is used herein for purposes of reference only, and thus is not intended to be limiting. For example, terms such as "upper", "lower", "above", and "below" refer to directions in the drawings to which reference is made. Terms such as "front", "back", "rear", "bottom" and "side", describe the orientation of portions of the component within a consistent but arbitrary frame of reference which is made clear by reference to the text and the associated drawings describing the component under discussion. Such terminology may include the words specifically mentioned above, derivatives thereof, and words of similar import. Similarly, the terms "first", "second" and other such numerical terms referring to structures do not imply a sequence or order unless clearly indicated by the context.

When introducing elements or features of the present disclosure and the exemplary embodiments, the articles "a", "an", "the" and "said" are intended to mean that there are one or more of such elements or features. The terms "comprising", "including" and "having" are intended to be inclusive and mean that there may be additional elements or features other than those specifically noted. It is further to be understood that the method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

It is specifically intended that the present invention not be limited to the embodiments and illustrations contained herein and the claims should be understood to include modified forms of those embodiments including portions of the embodiments and combinations of elements of different embodiments as come within the scope of the following claims. All of the publications described herein, including patents and non-patent publications, are hereby incorporated herein by reference in their entireties.

We claim:

1. A low back-travel medical traction system comprising:

an elongate track adapted to attach to a patient support to extend along an adjustment axis positionably fixed with respect to a patient on a patient support; and

a traveler inter-fitting with the elongate track to slide along the adjustment axis and having a traction strap attachment point and a first handle for tensioning a traction strap by pulling the traveler along the elongate track, the traveler providing an upwardly extending lever and first and second cam surfaces engaging with the elongate track to:

(a) allow free sliding of the traveler along the elongate track in an adjustment state with the upwardly extend-

ing lever within a first angular range about a horizontal axis perpendicular to an extent of the elongate track;

(b) lock the traveler on the elongate track in a fixation state with the upwardly extending lever at a locking angle about the horizontal axis tipped relative to the first angular range toward the patient support;

wherein the traction strap attachment point is on the upwardly extending lever whereby tension on the traction strap urges the first and second cam surfaces into the fixation state; and

wherein the first handle attaches to the upwardly extending lever at a first handle attachment point no higher than the traction strap attachment point.

2. The low back-travel medical traction system of claim **1** wherein the traction strap attachment point is a hole.

3. The low back-travel medical traction system of claim **1** wherein a line between the first handle attachment point and the traction strap attachment point is angled with respect to the adjustment axis by at least 10° and less than 30° upwardly toward the patient to approximate an angle of the traction strap during use.

4. The low back-travel medical traction system of claim **1** wherein the first handle is a bar extending from the first handle attachment point on both sides of the upwardly extending lever in a direction perpendicular to the adjustment axis.

5. The low back-travel medical traction system of claim **1** further including a second handle positioned on the upwardly extending lever at a point no lower than the traction strap attachment point.

6. The low back-travel medical traction system of claim **5** wherein the second handle is an arcuate extension of the upwardly extending lever concave toward the patient.

7. The low back-travel medical traction system of claim **1** wherein a force on the traction strap attachment point produces a torque on the upwardly extending lever pressing the first and second cam surfaces against the elongate track with a normal force at least two times the force on the traction strap attachment point.

8. The low back-travel medical traction system of claim **1** wherein the traveler provides guide surfaces engaging with the elongate track in the adjustment state to align the traveler with the adjustment axis.

9. The low back-travel medical traction system of claim **1** wherein a line between the traction strap attachment point and a pivot point defining rotation of the upwardly extending lever within a vertical plane of the adjustment axis is within 10° of vertical when the elongate track is horizontal and the upwardly extending lever is in the fixation state.

10. The low back-travel medical traction system of claim **1** wherein the elongate track provides a tubular channel open at a slot along the extent of the elongate track with the first and second cam surfaces fitting within the tubular channel and the upwardly extending lever passing through the slot; and

wherein the first and second cam surfaces engage interior surfaces of the tubular channel so that fingers of an average adult operator are blocked from contact with the first and second cam surfaces in the tubular channel.

11. A low back-travel medical traction system comprising:

an elongate track adapted to attach to a patient support to extend along an adjustment axis positionably fixed with respect to a patient on a patient support; and

a traveler inter-fitting with the elongate track to slide along the adjustment axis and having a traction strap attachment point and a first handle for tensioning a traction strap by pulling the traveler along the elongate track, the traveler providing an upwardly extending lever and first and second cam surfaces engaging with the elongate track to:

(a) allow free sliding of the traveler along the elongate track in an adjustment state with the upwardly extending lever within a first angular range about a horizontal axis perpendicular to an extent of the elongate track;

(b) lock the traveler on the elongate track in a fixation state with the upwardly extending lever at a locking angle about the horizontal axis tipped relative to the first angular range toward the patient support; and

wherein the first cam surface is a shaft pair extending perpendicularly to the adjustment axis and fitting within opposed corresponding interior grooves of the elongate track to be guided by the interior grooves along an extent of the elongate track independent of contact between the traveler and other portions of the elongate track and wherein the second cam surface is a portion of the upwardly extending lever, displaced from the shaft pair.

12. The low back-travel medical traction system of claim **11** wherein a distance between the shaft pair and the traction strap attachment point is at least twice a distance between the shaft pair and a contact point between the upwardly extending lever and the elongate track in the fixation state.

13. The low back-travel medical traction system of claim **1** further including a traction strap attached to the traction strap attachment point and providing a loop fitting around a patient's heel and further including a stabilizer strap attaching to opposite sides of the loop at the heel of a supine patient and passing over a top of the patient's foot to retain the loop on the heel against downward force.

14. The low back-travel medical traction system of claim **1** further including a patient support for supporting a supine patient attached to the elongate track so that the adjustment axis is parallel to an upper surface of the patient support.

15. The low back-travel medical traction system of claim **1** wherein the first and second cam surfaces have fixed separation.

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